СЕКЦИЯ ТЕХНОЛОГИИ И ЭЛЕКТРОХИМИИ НЕОРГАНИЧЕСКИХ МАТЕРИАЛОВ

MAGNETIC PROPERTIES OF FeNi NANOPARTICLES OBTAINED BY THE ELELCTRIC EXPLOSION OF WIRE

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Magnetic nanoparticles (MNPs) are being intensely studied with focus on technological applications in microwave range [1]. In this work weakly aggregated magnetic metallic nanoparticles of $Fe_{63.5}Ni_{36.5}$ composition were prepared by the technique of the electrical explosion of wire using different conditions: selected values of the over heating rates. Overheating (K) or the ratio of the energy injected into the wire to the sublimation energy of the wire metal. X-ray diffraction, transmission electron microscopy, low temperature nitrogen adsorption and magnetic measurements were used for the characterization of MNPs. Increase of the energy injected into the wire led to increase of the specific surface (S_{sp}) of the produced MNPs from 4.6 to 13.5m^2/g. The fabricated MNPs were spherical and weakly aggregated with the average weighted diameter in the range of 54–160 nm depending on the Ssp. The phase composition of FeNi MNPs consists of two solid solutions of Ni in α-phase and γ-phase lattices. The increase of the energy injected into the wire leads to increase of the α-phase from 5 to 10 wt% as the injected energy raised from 0.8 to 2.5 times the sublimation energies of the material of the wire (Table). The obtained high values of the saturation magnetization are in accordance with phase composition and average diameters of the MNPs. Comparative analysis of structure and magnetic properties showed that the obtained MNPs are important magnetic materials with high saturation magnetization which can be suitable for important technological applications, including applications microwave frequency range.

Technological parameters for EEW MNPs processing: C - capacitance of the capacitor bank; Uo – voltage corresponding to the charged capacitor bank just prior to explosion; l – the wire length; K - overheating or the ratio of the energy injected into the wire to the sublimation energy of the wire metal, W_s – sublimation energy for the wire of the lengths l and $W_0 = CU_0^2/2$ and M_s – is a saturation magnetization at 300 K.

Sample	U_0, kV	C, mcF	l, mm	K = W_0/Ws	S_{sp}, m^2/g	γ-phase		
						%	D_{csr}, nm	M_s, emu/g)
FeNi -1	30	3.2	70	2.3	13.5	90	34	140
FeNi -2	30	1.6	70	1.9	12.1	90	36	130
FeNi -3	20	1.6	70	1.2	7.8	93	60	70
FeNi -4	20	1.6	100	0.8	4.6	95	83	40

1. Kurlyandskaya G.V., Safronov A.P., Terzian T.V. et al. Fe45Ni55 magnetic nanoparticles obtained by electric explosion of wire for the development of functional composites // IEEE Magnetic Letters. 2015. V. 6. P. 3800104.

Selected measurements were performed at SGIker services of UPV-EHU. This work was supported by the Russian Federation state assignment # 0389-2014-0002 and Spanish MECMAT 2014-55049-C2-1-R grant.

THE EFFECT OF DIFFERENT AC CURRENT DENSITY ON THE MAGNETOIMPEDANCE OF CoFeMoSiB AMORPHOUS RIBBONS IN THE PRESENCE OF IRON OXIDE NANOPARTICLES WATER BASED FERROFLUID

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Biocompatible magnetic nanoparticles (MNPs) are widely proposed for different biomedical applications. For the majority of them they must be prepared as water-based ferrofluids. Magnetic biosensing is a promising